Abstract

Due to global warming and a changing climate, the frequency and intensity of hurricanes are expected to increase. Hurricane Sandy in October/November 2012 struck the New York and New Jersey coastal areas and resulted in approximately $50 billion of property damage and 72 deaths in the United States. Three years ago from Hurricane Sandy, at the American Society of Civil Engineers 2009 conference, in an attempt to mitigate the damage by the storm surge four conceptual designs of storm surge barriers had been suggested by CDM Smith at the Arthur Kill (a waterway between Staten Island and New Jersey), by ARCADIS just north of the Verrazano-Narrows Bridge, by Parsons Brinckerhoff at the upper East River between Throgs Neck and southern tip of Manhattan Island, and by CH2M between the Sandy Hook peninsula in New Jersey and the Rockaway Beach. After Hurricane Sandy, there have been a number of proposals to mitigate the storm surge and improve the resiliency of waterfront communities, one of which is called a “Big U,” proposed by the company BIG along with 9 other teams including OMA and WXY in 2014. The Big U is a protective system that encircles Manhattan, stretching from West 57th Street south to The Battery and up to East 42nd Street.

In this thesis, the effectiveness of each of four proposed storm surge barriers and Big U in mitigating the height of the storm surge is studied using computer software, SMS – ADCIRC. SMS, developed by *aquaveo company*, stands for Surface-water Modeling System, which includes a number of coastal and riverine models, and ADvanced CIRCulation Model (ADCIRC) is one of its coastal models. The results show that the proposed sea walls are effective in mitigating the water surface elevation inside the barriers and that, as compensation, an increase in the height of the storm surge is detected outside the barriers, which should be considered

during the design of these walls. The barrier at the Arthur Kill reduces the height of the storm surge at the narrow channel between Staten Island and New Jersey, and the barrier near the Verrazano-Narrows Bridge mitigates the storm surge near Manhattan Island. The barrier at the upper East River reduces the height of the storm surge between Queens and Bronx, including LaGuardia Airport. The longest barrier between the Sandy Hook peninsula and the Rockaway Beach gives the largest protection of the New York/New Jersey coastal area, including Staten Island, Manhattan, and Brooklyn.

The Big U is represented by a U-shaped wall that encircles Lower Manhattan in the simulation. From the Big U simulation, the east side of Manhattan is protected by the wall and gives zero water surface elevation, while the west side shows an increase in the water surface elevation even with the wall. It has been concluded that the software modeling is accurate in calculating the macroscopic scale problems, but not the microscopic scale ones.